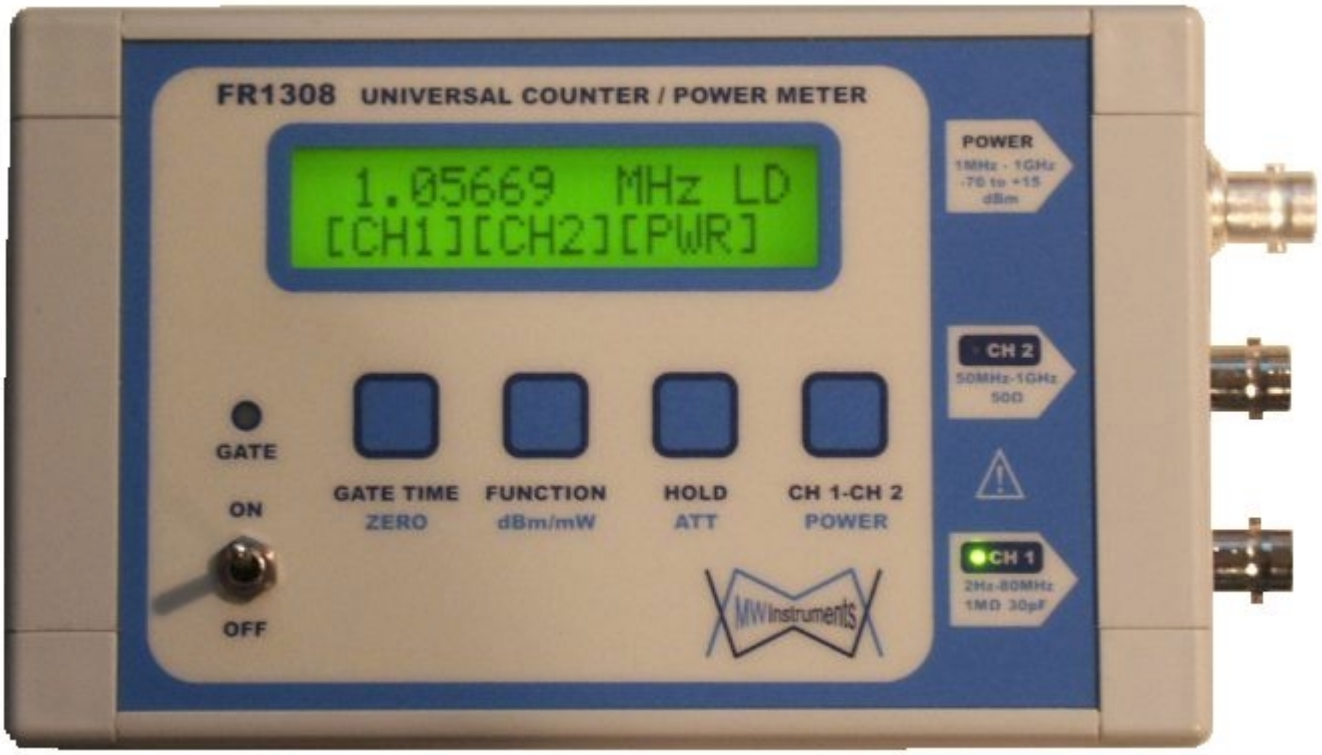
UNIVERSAL TIMER/COUNTER
RF POWER METER
FR1308

ASSEMBLY MANUAL



Copyright MW Instruments (C) 2005

http://www.mwinstruments.com

Manual N° MME1308-0601

1) INTRODUCTION

The FR1308 is an instrument that permits measurement of frequencies, period, pulse duration, and RF power. Please refer to the user manual for all informations regarding the use of this instrument.

The kit FR1308 contains all required material including a special enclosure complete with a professionnal polycarbonate (Lexan) front panel overlay.

To obtain reliable results, the FR1308 must be calibrated after its assembly. For this purpose MW Instruments recommandes a small but accurate frequency/power calibrator (ref CL2018). The calibration procedure is described in the user manual.

All kits from MW Instruments are evolutive. New features are added from time to time and can be upgraded by changing the microcontroller. Please visit our Web site http://www.mwinstruments.com (support section) for upgrade procedures.

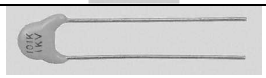
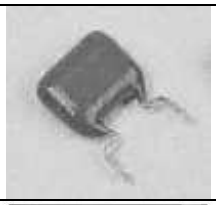
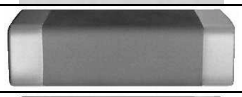
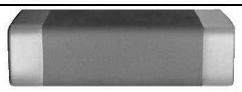
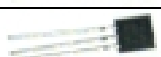
The FR1308 is intended for persons having some experiences in kit assembly. The instrument has some SMD passive components (Surface Mounted Components) but this should not be a problem if you use an appropriate solder iron. Many drawings and pictures will help you in the assembly of this instrument.

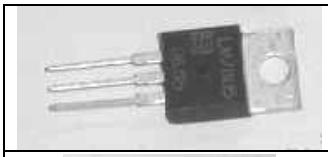
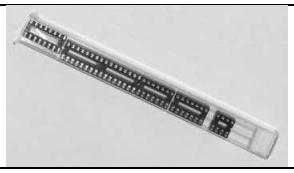
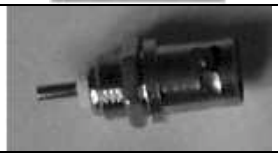
If you have any questions about this kit, feel free to contact the project designer at info@mwinstruments.com.

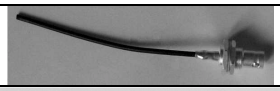
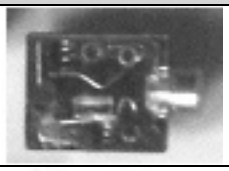
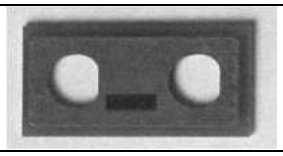
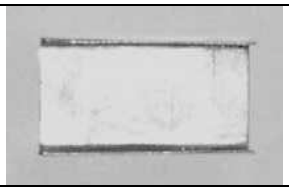
2) COMPONENT PARTLIST

This section describes the contents of the FR1308 kit. Please check all parts supplied in the kit bag against the list shown here. We have done our best to provide all parts without errors, but sometimes shortages do occur. If you find that you are missing a component, after carefully going through the parts bag and identifying the components against this part list, please contact us.

Picture	Q^{ty}	Ref.	Description
	1	R33	Resistor 5,6 ohms 5% (GREEN BLUE GOLD GOLD)
	1	R34	Resistor 52,3 ohms 1% (GREEN RED ORANGE GOLD BROWN)
	1	R10	Resistor 62 ohms 5% (BLUE RED BLK GOLD)
	1	R19	Resistor 100 ohms 1% (BROWN BLK BLK BLK BROWN)
	1	R22	Resistor 220 ohms 5% (RED RED BROWN GOLD)
	1	R4	Resistor 464 ohms 1% (YELL. BLUE YELL. BLK BROWN)
	5	R5 R18 R28 R29 R40	Resistor 470 ohms 5% (YELL. VIOLET BROWN GOLD)
	1	R15	Resistor 1 k 1% (BROWN BLK BLK BROWN BROWN)
	1	R14	Resistor 2,74 k 1% (RED VIOLET YELL. BROWN BROWN)
	5	R8 R11 R23 R27 R39	Resistor 4,7 k 5% (YELL. VIOLET RED GOLD)
	1	R38	Resistor 4,87k 1% (YELL. GREY VIOLET BROWN BROWN)
	5	R2 R12 R13 R30 R37	Resistor 10k 1% (BROWN BLK BLK RED BROWN)
	5	R1 R3 R25 R6 R26	Resistor 11 k 5% (BROWN, BROWN, RED, GOLD)
	3	R24 R31 R35	Resistor 20,5 k 1% (RED BLK GREEN RED BROWN)
	1	R9	Resistor 22 k 5% (RED RED ORANGE GOLD)
	1	R32	Resistor 33,2 k 1% (ORANGE ORANGE RED RED BROWN)
	1	R36	Resistor 56 k 5% (GREEN BLUE ORANGE GOLD)
	1	R21	Resistor 100 k 1% (BROWN BLK BLK ORANGE BROWN)
	1	R16	Resistor 100 k 5% 2W Oxydmetal (BROWN BLK ORANGE GOLD)
	1	R17	Resistor 898 k 1% (GREY BLANC GREY ORANGE BROWN)

Picture	Qty	Réf.	Description
	1	AJ1	Adjustable Potentiometer 47 k
	1	AJ2	Adjustable Potentiometer 4,7 k
	1	AJ3	Adjustable Potentiometer 250 R
	1	AJ4	Adjustable Potentiometer 20K 20 turns
	9	C1 C2 C3 C4 C5 C7 C12 C13 C14	Capacitor 100nF 5OV
	1	C18	Capacitor Ceramic 100pF 50V
	1	C16	Capacitor Ceramic 100pF 400V
	2	C8 C9	Capacitor electrolytic 10µF 63V
	1	C19	Capacitor electrolytic 100µF 25V
	1	C15	Capacitor polyester film 100nF 400V
	4	C20 C21 C22 C23	Capacitor SMD 1nF 1206 (GREEN marking)
	1	C24 C26 C27 C28	Capacitor SMD 22nF 1206 (RED marking)
	3	LD1, LD2, LD3	LED 3mm GREEN
	1	D1	Diode 1N4004
	4	D2 D3 D4 D5	Diode 1N4149
	2	Q1 Q3	NPN Transistor BC547B
	2	Q4 Q7	PNP Transistor BC557B
	1	Q2	JFET N-channel BF245A

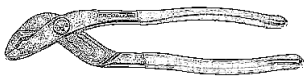
	1	U4	Regulator 5V 500mA 78M05
	1 1 1 1 1 1 1 1 1 1	U9 U3 U2 U1 U7 U8 U10 U12 U13 U5	MC74F00N CD74HC4520 74AC74 74F257AN M74HC4052B1 MAX903CPA U664B LM358AN AD8307AN PIC16F916 programmed
	1	U14	TCXO 20 MHz (already soldered in the main board)
	1	AFF1	LCD display 2 lines of 16 characters with backlight
	4		Ferrite bead
	4	PB1, PB2, PB3, PB4	MICROTOUCHE
	2	(U2 U9)	Socket CI 14 points
	3	(U1 U3 U7)	Socket CI 16 points
	1	(U12)	Socket CI 8 points
	1	(U5)	Socket spécial 28 broches pour PIC
	3	CN1 CN2 CN3	Socket SIL 6 pins
	3	CN4 and LCD	Male header 6 pins
	2		BNC sockets

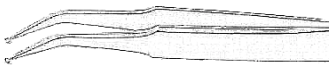
	1		BNC socket with coaxial cable
	1		9V battery socket
	1		jack 3.5mm stereo
	1		jack 2.5mm mono
	1		On-Off switch
	1		Printed Circuit board for BNC
	1		**Cables Pack** • Coaxial cable RG179 10cm • 2 yellow wires L = 6 cm • 2 brown wires L = 4 cm • 2 red wires L = 4 cm • 1 yellow wire L = 4 cm
	1		Front panel overlay (polycarbonate)
	1		Enclosure
	1		Printed circuit board FR1308M-050714
	1		Printed circuit board FR1308K-050714
	1		Shield

3) TOOLS REQUIRED

In order to properly assemble the kit, the following tools are required:

- Solder iron, 25W power
- Screwdriver
- Small screwdriver for adjustments
- Adjustable pliers or wrench (for BNC socket mounting)
- Wire cutters
- Needlenose pliers
- Tweezers (for SMD mounting)





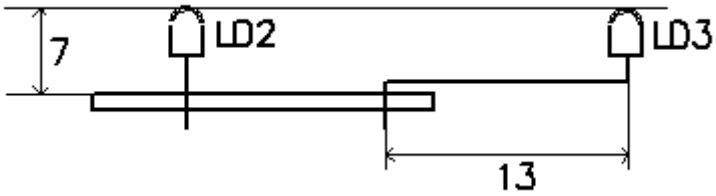
4) ASSEMBLY ORDER

The kit will be assembled in the order below :

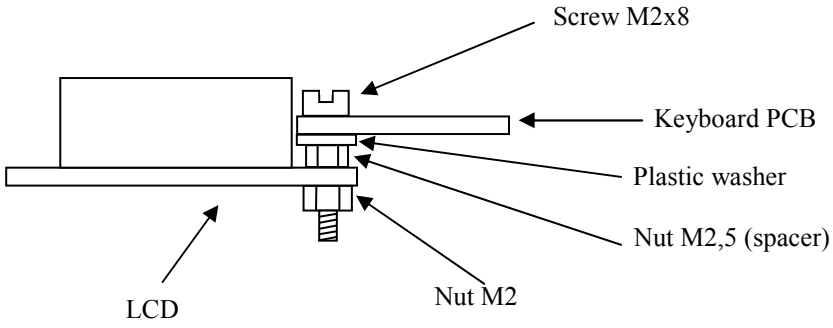
A- Display-keyboard assembly
B- Main board assembly
C- Final assembly

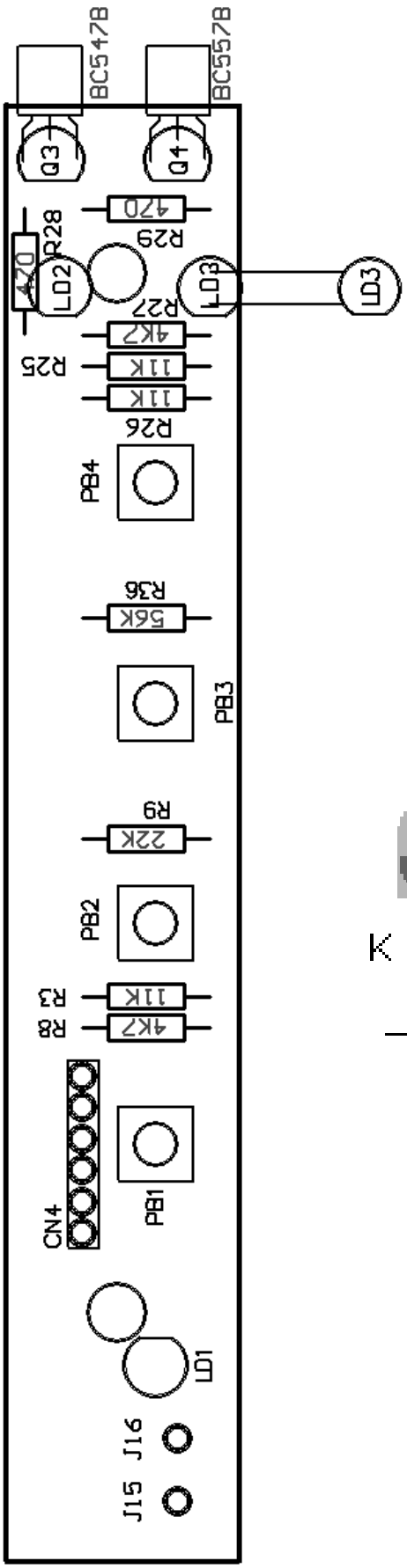
5) DISPLAY-KEYBOARD ASSEMBLY

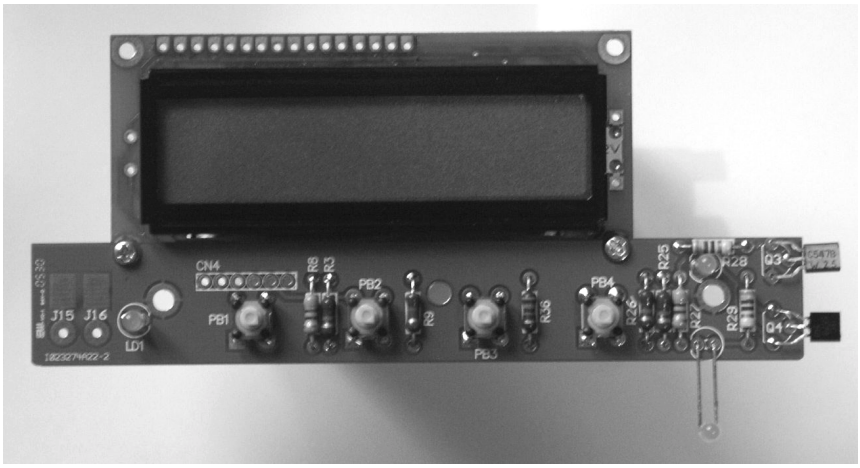
Start with soldering all resistors followed by the push-buttons, insuring that the push-buttons are inserted flush to the printed circuit board. Q3 and Q4 transistors will be mounted horizontally and laid flat on the printed circuit. The 6 pin male header CN4 will be soldered later. Install LEDs LD1 and LD2 will a distance of 7 mm between the printed circuit and the top of the LEDs. The LEDs will have to be soldered perpendicular to the printed circuit so that they seat in the holes of the cover. The LD3 LED will be soldered according to the drawing opposite. The LCD will be fixed on the keyboard by two 2mm screws. A 2mm spacer will be placed between the keyboard and the display. This spacer is a M2.5 nut with 2mm thickness.



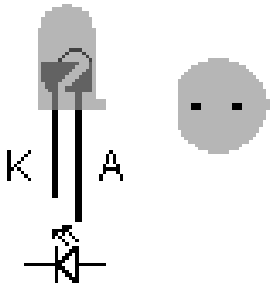
The connection of the display-keyboard assembly to the main board is through three 6-pins male headers, which will be soldered in a later step.



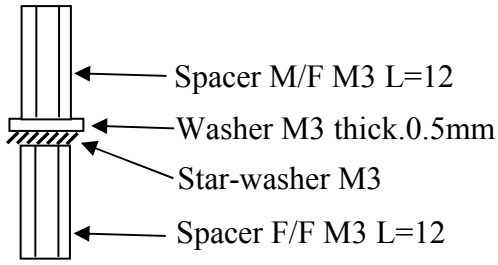




The keyboard-display assembly will be secured to the main printed circuit board with to two spacers of 25,5 mm (1.004") formed by assembling two 12 mm spacers and two washers. Mounting of the keyboard-display assembly to the main board will be performed in a later step.



Spacers preparation



6) MAIN BOARD ASSEMBLY

6-1 SMD capacitors soldering

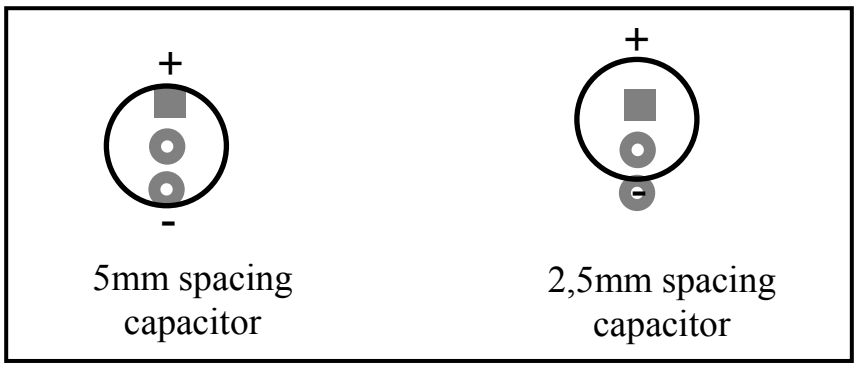
SMD capacitors will be first soldered to the main board first. Take care to not mix the values. The 22nF and 1nF capacitors are marked respectively by a red line and a green line. In case of doubts you can measure their capacity with a capacitance meter. These capacitors are 1206 format and should not introduce any special problem in soldering them. The TCXO oscillator (U14) is already soldered in the board.

6-2 Install Resistors

The Resistors will be soldered by referring to the drawing given at the page 15. Take care to not mix the values. Certain values as 11K and 22K have colors that can easily be confused. The R40 resistor is not indicated on the silk screeen of the board. This resistor is installed between R10 and J9/J10. R17 resistor will be soldered slightly elevated from the printed circuit. Resistor R7 and R20 are not used. Be carrefull not to mix the resistor labelled R34 (52.3 ohms) and R3 which is in the keyboad assembly. The "4" figure doesn't appear in the silk screen of the pcb.

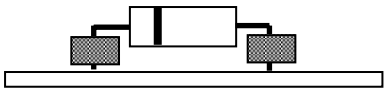
6-3 Install Capacitors

Start with installing the 100nF ceramic capacitors, following by C16 and C18 capacitors (100 pF each). Take care to not invert these capacitors, C16 has a 400V working voltage and has a thicker body than C18. The electrolytic capacitors will be soldered next. Observe the polarity of these caps. The printed circuit board can receive capacitors with 2.5 or 5 mm spacing. In the case of capacitors with 2,5 mm spacing, take care to solder them with the correct orientation. The soldering pads in common are the negative terminal of the capacitor. The positive terminal always corresponds to the square soldering pad.



6-4 Install Diodes

Install D3 and D4 diodes with a ferrite bead at each terminal. Install D2 and D5 diodes. Observe proper orientation of the banded end. Install D1 diode.



6-5 Install Adjustable potentiometer

The AJ4 multi-turn potentiometer will be soldered with its screw on the left side, as indicated in the silk screen. Install The AJ1, AJ2 and AJ3 potentiometer.

6-6 Install Transistors

Install the transistors according to the silkcreen outlines. The field effect transistor Q2 has a double silk screen marking on the circuit board. In the case of a BF245A it will be soldered with the flat side toward R18 (the marking is the dotted line on the printed circuit board). The FET is sensitive to the electrostatic discharges. Take proper grounding precautions when handling.

6-7 Install Integrated circuits

Integrated circuits U8, U10 and U13 will be directly soldered on the board, the remaining Ics will be equipped with sockets. Observe orientation of each IC or socket. The microcontroller socket is a special one and is made with two superimposed sockets. The metallic tab of the regulator (U4) is oriented towards the edge of the circuit board.

6-8 Connector assembly

The soldering of the three connectors CN1, CN2 and CN3 will complete the assembly of the main board. These connectors must be soldered flush and perpendicular to the printed circuit. Carefully inspect all solder connections as well as checking for the correct placement of all components, in particular the active devices. When all seems correct, clean soldering rosin from the circuit boards with a flux remover.

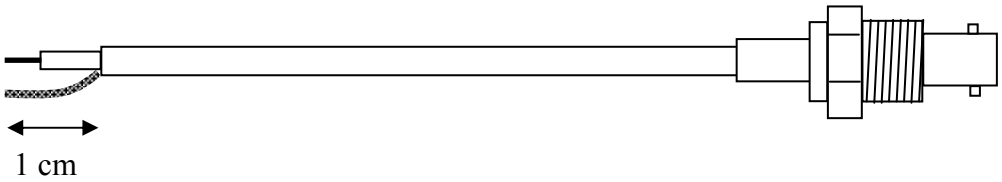
6) ASSEMBLING THE TWO BOARDS

Fix the two spacers to the main board with two M3 screws. A star-washer will be inserted between the head of the screw and the bottom of the pcb. Install the three male headers into the corresponding connectors (CN1, CN2, CN3) on the main board. Install the display-keyboard assembly, aligning all the pins of the 3 male headers into the holes of the display-keyboard assembly. Fix the display-keyboard assembly to the spacers with two M3 screws. Solder the three male headers to the display board and the lcd.

7) ENCLOSURE PREPARATION

6-1 BNC connectors assembly

The end of the BNC equipped coaxial cable jacket will be stripped to a lenght of approximately 1 cm (0.4”). Take care not to cut the braid of the cable during this opération. Tin-plate the central wire as well as the braid.

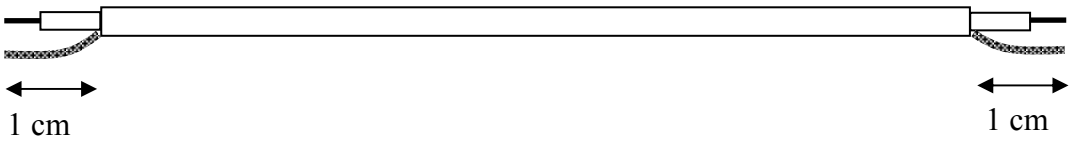


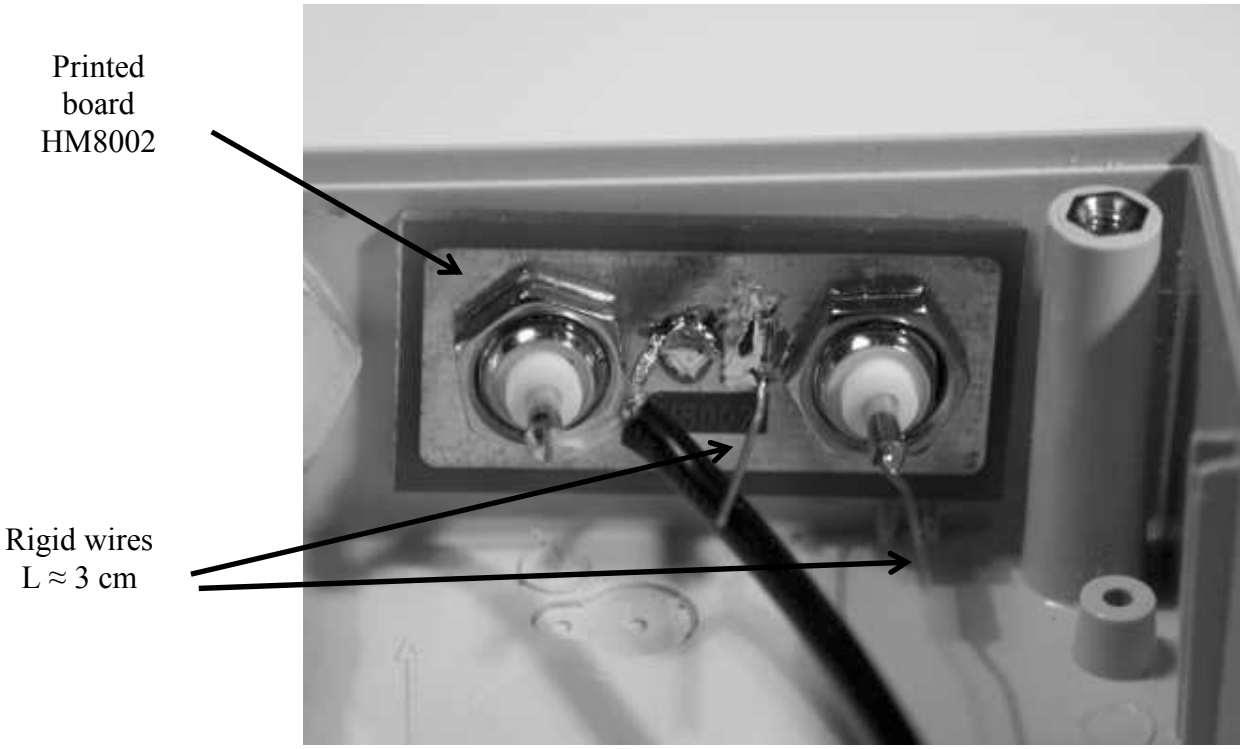
Install the BNC socket into the enclosure, insuring that the socket is securely attached by tightening the nut with adjustable pliers or appropriate wrench.
Insert the two remaining BNC connectors through the holes of the enclosure. Place the small HM8002 printed circuit board over the two BNC connectors with the provided nuts. The nuts will have to be tightened so that the BNC connectors will not unscrew themselves when a BNC cable is connected.

The BNC connector for CH 1 will require a piece of rigid wire (scrap resistor lead) of about 3 cm (1.2”) long soldered to the center pin. A second wire will be soldered in the

center of the ground plane of the HM8002 between the two BNC connectors. These wires will be sodered later to the main board soldering pads J7 and J8.

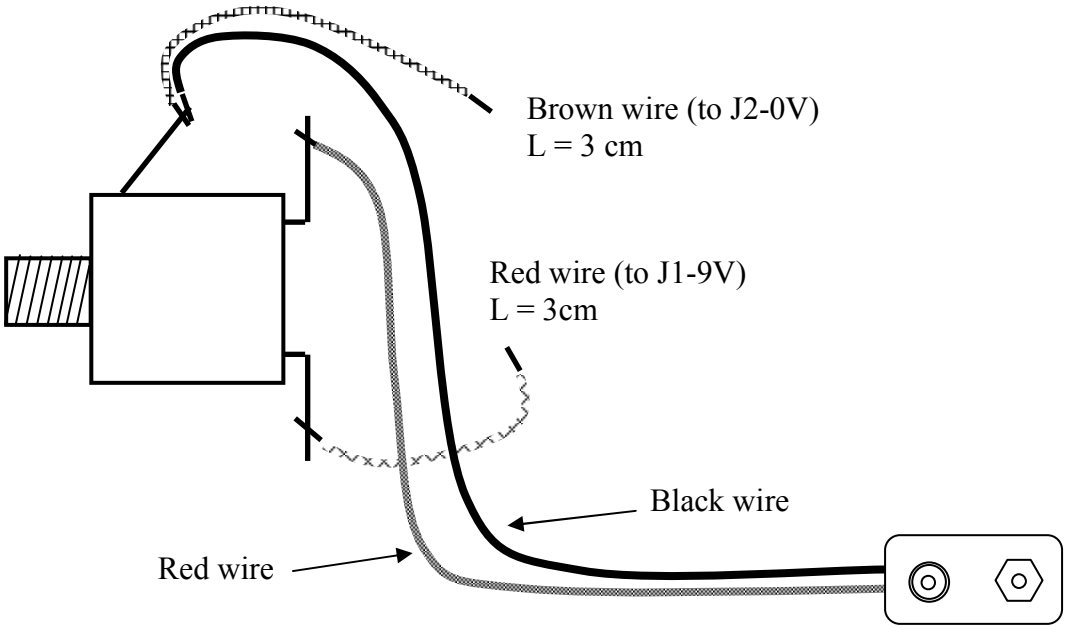
The soldering of the coaxial cable to the second BNC connector remains to be done. Strip both ends of the coax cable to a lenght of approximately 1cm (0.4”). Tin-plate the central wire as well as the braid. The insulation material of the cable can melt easily under hot temperature, so don’t apply too much heat during this operation.





6-2 Power supply 2,5mm jack assembly

The connector will be fixed to the enclosure as shown in the drawing below. The red and brown wires will be soldered on the main board later. The 3.5mm jack connector wil be mounted later as well.



6-3 First testing

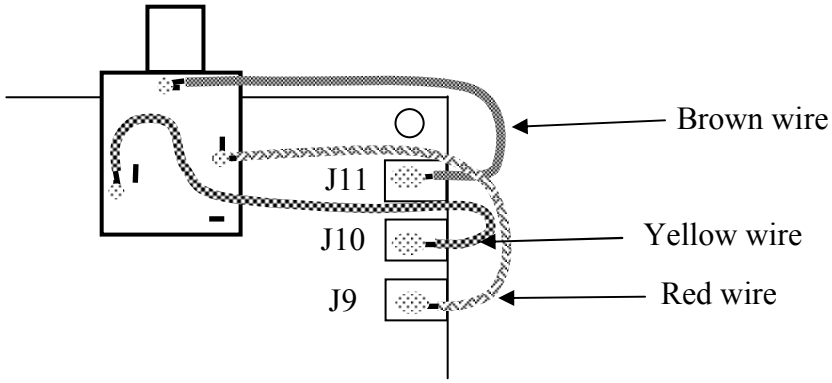
Before the final assembly, a brief test shouldl be performed. Connect a DC voltage, between 9 and 15V, to J1 (positive terminal) and J6 (ground). Place a short between J5 and J6 on the keyboard circuit. Adjust the AJ2 potentiometer for the best contrast on the LCD. If there is nothing on the screen, disconnect the power supply and check the work. Set the wipers of AJ3 and AJ1 to midscale positions. Test that the keyboard is working normally by pressing the keys and observing the display. Use a signal generator and check that all inputs work normally. The sensitivity is not optimal at this time and the power meter will give incorrect values. If everithing is ok you can proceed to the final installation in the enclosure.

6-4 Final installation

Solder the powermeter input coaxial cable to J3 (central wire) and J4 (braid) soldering pads. Soder the shield over the powermeter circuit (AD8307). Be careful to leave enough space around the mounting hole in the corner for the screw. Secure the board to the enclosure with four screws. Solder the power supply wires according to the drawing of paragraph 6-2. Solder the CH2 input coaxial cable to J6 (braid of the cable) and J5 (center wire) soldering pads.
Solder the two solid wires from CH1 input to J7 (input) and J8 (ground) soldering pads.

Extension connector assembly

Fix the jack connector horizontaly with the terminals on the top. Solder the three wires according to the drawing below.

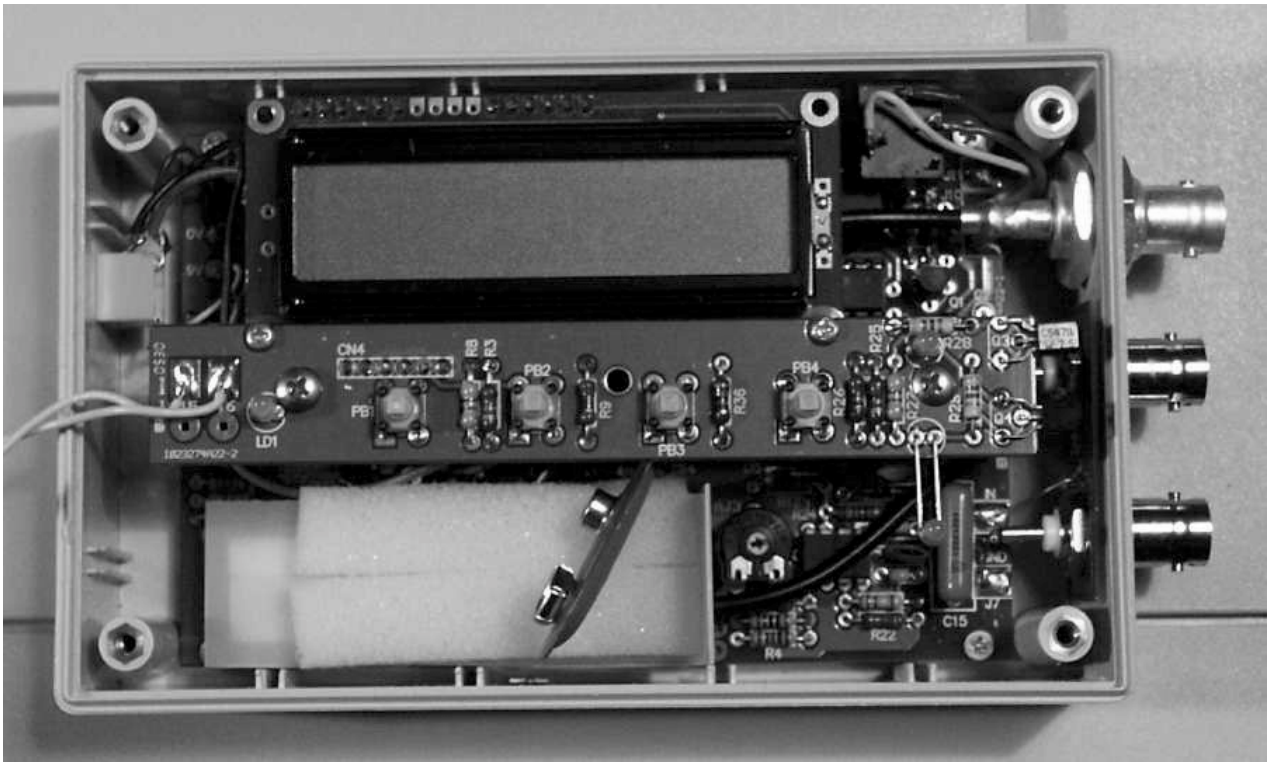


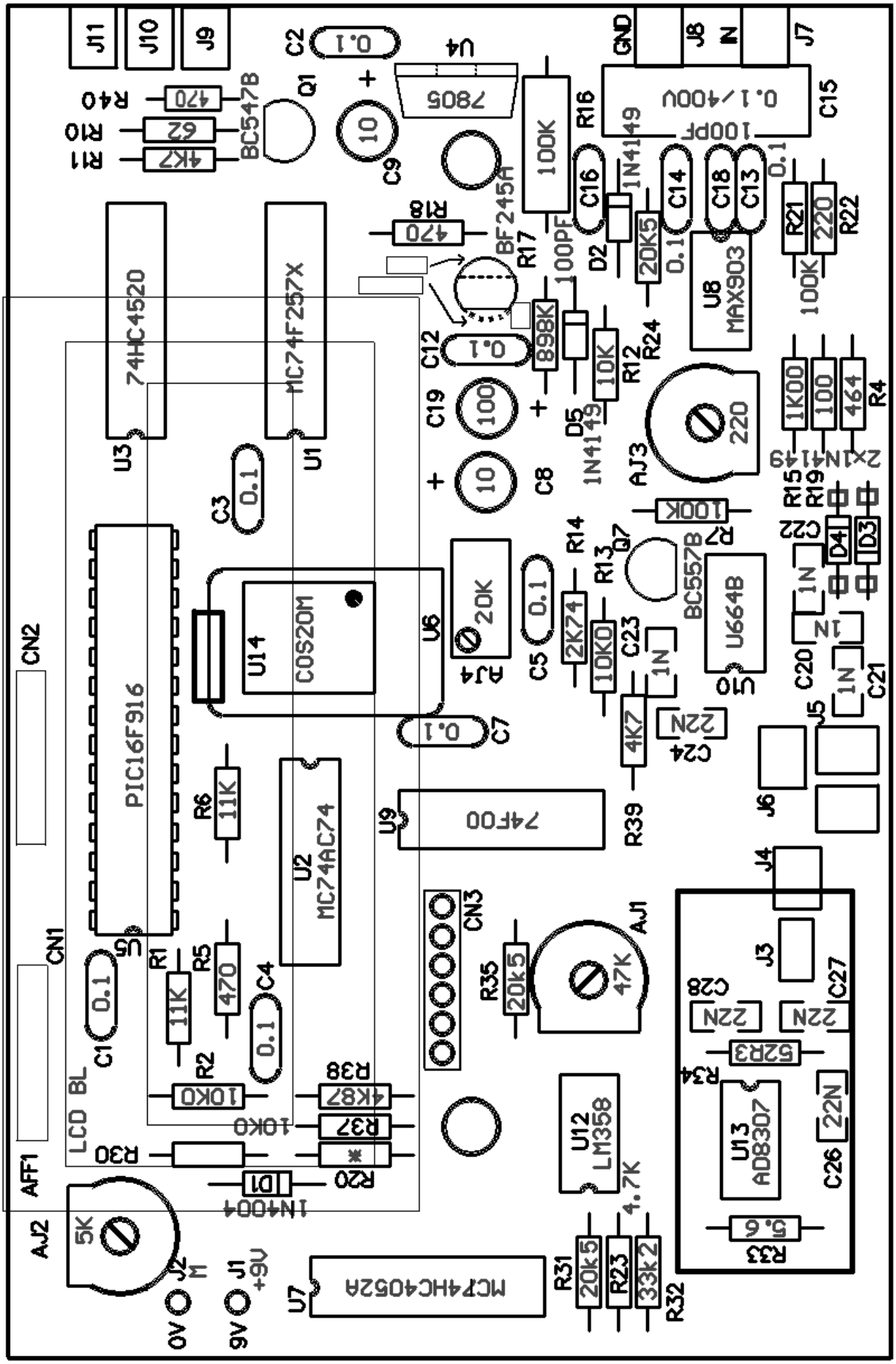
On-Off switch mounting

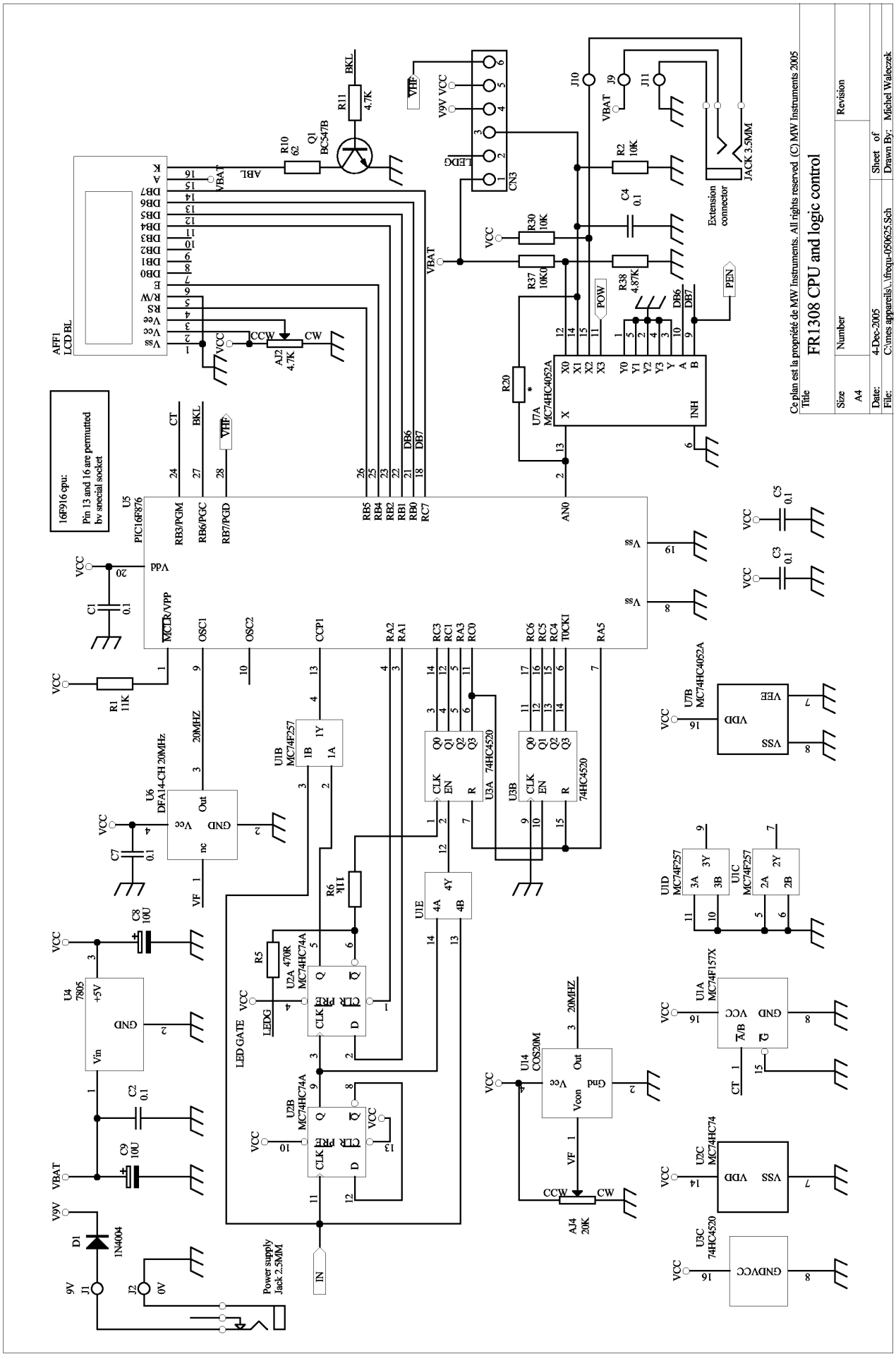
Remove the short placed on J15 and J16. The on-off switch will be connected to J15 and J16 soldering pads of the keyboard circuit by two 6 cm (2.4") wires.

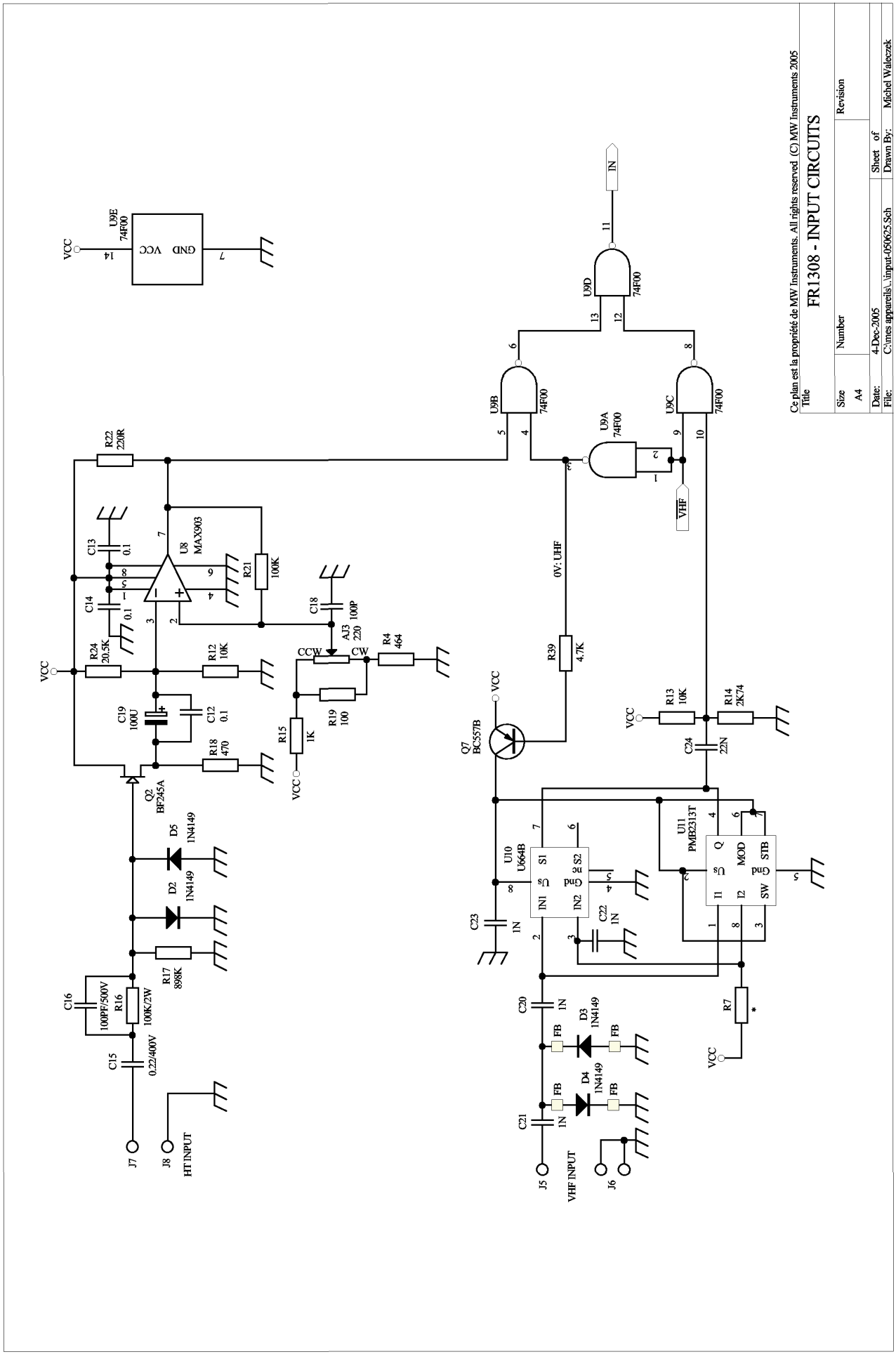
Cover mounting

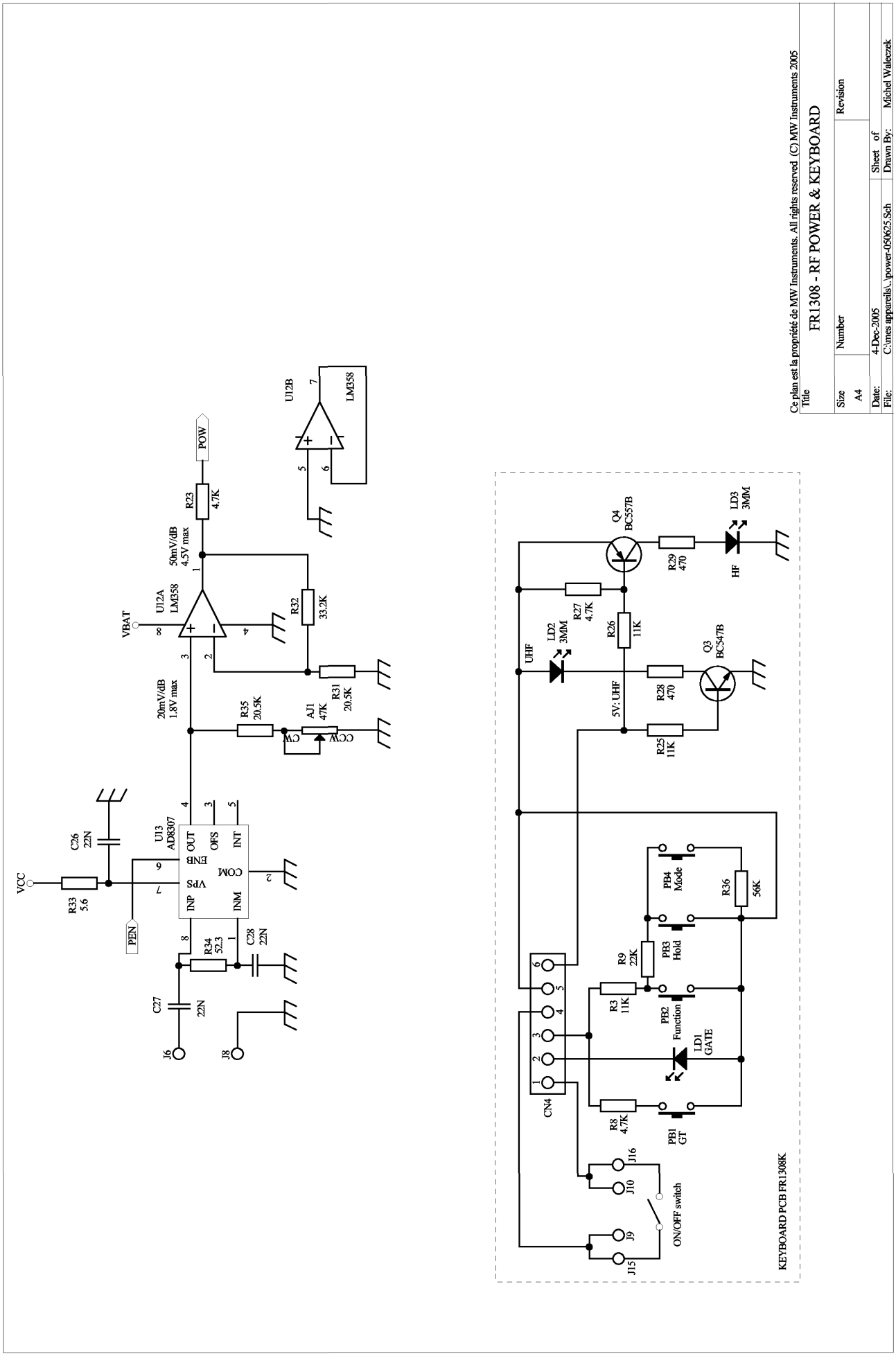
Adjust the position of the LD3 LED so that it seats in the hole in the cover. The three LEDs must extend past the surface of the cover. Check that the surface is clean and apply the Lexan cover film.. Screw the cover to the enclosure thanks to the four screws. Place the baterry holder above the power circuit shield as indicated in the picture below. The assembly of the FR1308 is now finished. Before using it you have to calibrate it. Please consult the user manual for details.




J11
J10
J9
C2
0.1
U4
7805
GND
J8
IN
J7
R40
470
R10
62
R11
4K7
Q1
BC547B
C9
10
BF245A
R16
100K
0.1/400V
C15
100PF
R18
470
R17
C16
1N4149
C14
C18
C13
0.1
R21
220
R22
100K
D2
20K5
0.1
U8
MAX903
100PF
898K
R12
10K
R24
C12
0.1
C19
100
C8
10
D5
1N4149
AJ3
220
1K00
100
464
R4
2X1N4149
R15
R19
100K
R7
C22
1N
D41
D3
C20
1N
C21
1N
U14
COS20M
U6
20K
R14
2K74
R13
10K0
C23
1N
Q7
BC557B
U664B
C5
0.1
C7
0.1
C24
22N
4K7
R39
J5
J6
U9
74F00
U2
MC74AC74
R6
11K
CN3
R35
20k5
AJ1
47K
J4
J3
C28
22N
22N
C27
52R3
R34
U13
AD8307
22N
C26
5.6
R33
U12
LM358
4.7K
R31
20k5
R23
33k2
R32
U7
MC74HC4052A
74HC4520
U3
MC74F257X
U1
C3
0.1
CN2
PIC16F916
U5
CN1
C1
0.1
R1
11K
R5
470
C4
0.1
R2
10K0
R38
4K87
R37
10K0
R30
R20
D1
1N4004
LCD BL
AFF1
AJ2
5K
J2
M
0V
J1
+9V
9V


FR1308 CPU and logic control
Ce plan est la propriété de MW Instruments. All rights reserved (C) MW Instruments 2005
Title
Size
A4
Number
Revision
Date: 4-Dec-2005
File: C:\mes appareils\..\frequ-050625.Sch
Sheet of
Drawn By: Michel Waleczek
16F916 cpu:
Pin 13 and 16 are permutted
by special socket
U5
PIC16F876
U7A
MC74HC4052A
U7B
MC74HC4052A
U1A
MC74F157X
U1B
MC74F257
U1C
MC74F257
U1D
MC74F257
U1E
U2A
MC74HC74A
U2B
MC74HC74A
U2C
MC74HC74
U3A
74HC4520
U3B
74HC4520
U3C
74HC4520
U4
7805
U6
DFA14-CH 20MHz
U14
COS20M
AFF1
LCD BL
CN3
JACK 3.5MM
Extension
connector
Power supply
Jack 2.5MM
LED GATE
IN
VCC
VBAT
V9V
9V
0V
BKL
CT
PEN
POW
LEDG
ABL
CCW
CW
20MHZ


Ce plan est la propriété de MW Instruments. All rights reserved (C) MW Instruments 2005
Title
FR1308 - INPUT CIRCUITS
Size: A4
Number
Revision
Date: 4-Dec-2005
Sheet of
File: C:\mes appareils\..\input-050625.Sch
Drawn By: Michel Waleczek
VCC
GND
U9E 74F00
U9D 74F00
U9B 74F00
U9C 74F00
U9A 74F00
IN
VHF
0V: UHF
R22 220R
U8 MAX903
R21 100K
C13 0.1
C14 0.1
C18 100P
AJ3 220
CCW
CW
R4 464
R24 20.5K
R12 10K
R19 100
R15 1K
C19 100U
C12 0.1
R18 470
Q2 BF245A
R39 4.7K
Q7 BC557B
R13 10K
R14 2K74
C24 22N
U10 U664B
U11 PMB2313T
C23 1N
C22 1N
D5 1N4149
D2 1N4149
R17 898K
C16 100PF/500V
R16 100K/2W
C15 0.22/400V
C20 1N
C21 1N
D3 1N4149
D4 1N4149
FB
R7 *
J7
J8
HT INPUT
J5
VHF INPUT
J6


Ce plan est la propriété de MW Instruments. All rights reserved (C) MW Instruments 2005
Title
FR1308 - RF POWER & KEYBOARD
Size
A4
Number
Revision
Date: 4-Dec-2005
Sheet of
File: C:\mes appareils\..\power-050625.Sch
Drawn By: Michel Waleczek
KEYBOARD PCB FR1308K
ON/OFF switch
VCC
VBAT
PEN
POW
U12A LM358
U12B LM358
U13 AD8307
R23 4.7K
R32 33.2K
R31 20.5K
R35 20.5K
AJ1 47K
R33 5.6
R34 52.3
C26 22N
C27 22N
C28 22N
50mV/dB 4.5V max
20mV/dB 1.8V max
Q4 BC557B
Q3 BC547B
LD1 GATE
LD2 3MM
LD3 3MM
UHF
HF
5V: UHF
R25 11K
R26 11K
R27 4.7K
R28 470
R29 470
R36 56K
R9 22K
R3 11K
R8 4.7K
PB1 GT
PB2 Function
PB3 Hold
PB4 Mode
CN4
J6
J8
J9
J10
J15
J16

MW Instruments
12, rue du Lieutenant Colonel Quinette
95200 SARCELLES , FRANCE
Web : www.mwinstruments.com Email : info@mwinstruments.com
Tel: +33 (0) 8 71 13 71 39 Fax: +33 (0) 1 3992 4986